

X-743-72-257

NASA TM X-65966

COMPILATION OF WEIGHTS, BALANCE, CG, AND MOMENTS OF INERTIA FOR SOUNDING ROCKET PAYLOADS

(NASA-TM-X-65966) COMPILATION OF WEIGHTS,
BALANCE, CG, AND MOMENTS OF INERTIA FOR
SOUNDING ROCKET PAYLOADS J.J. Wolff, Jr.,
et al (NASA) Jul. 1972 35 p

N72-28887

CSCI 22B

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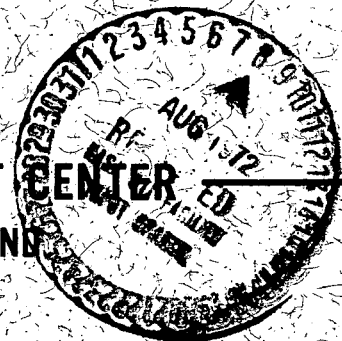
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JOHN J. WOLFF, JR.
JOHN F. FITZ

JULY 1972



GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND



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CG, AND MOMENTS OF INERTIA
FOR SOUNDING ROCKET PAYLOADS

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July 1972

GODDARD SPACE FLIGHT CENTER
Greenbelt, Maryland

COMPILATION OF WEIGHTS, BALANCE,
CG, AND MOMENTS OF INERTIA
FOR SOUNDING ROCKET PAYLOADS

SUMMARY

This document contains a compilation of weight, balance, center of gravity and moments of inertia of various Sounding Rocket Payloads that have been measured since January 1970. The information was obtained from data sheets prepared by the Test and Evaluation Division who also made the measurements.

The purpose of this document is to provide a permanent record of the physical characteristics of these sounding rocket payloads in one convenient location, and information as to the weight that prospective users can expect to fly on these types of Sounding Rockets.

The data contained in this document was measured at the GSFC Test and Evaluation Facility, and does not necessarily reflect the payload parameters at time of launch. Variations to these parameters can be expected because of final launch preparations.

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DEFINITIONS

Numbering System

NASA 1 Aerobee 100
2 Arcon
3 Nike Asp
4 Aerobee 150, 150A
5 IRIS
6 Aerobee 300
7 ARGO E-5
8 Javelin
9 Skylark
10 Nike Cajun
11 ARGO D-8
12 Special Projects

NASA 13 Aerobee 170
14 Nike Apache
15 Arcus
16 Astrobee 1500
17 Aerobee 350
18 Nike Tomahawk
19 Black Brant IV
20 Bullpep Cajun
21 Black Brant VC
22 Black Brant IIIB
23 Astrobee D

Identifying Letters

The Letters which follow each rocket number identify -

- (1) the instrumenting agency, and
- (2) the experiment, according to the following list:

1. AGENCY

G - Goddard
N - Other NASA Centers
U - College or University
D - DOD
A - Other Government Agency
C - Industrial Corporations
I - International

2. EXPERIMENT

A - Aeronomy
B - Biological
E - Energetic Particles and Fields
G - Galactic Astronomy
I - Ionospheric Physics
L - Lunar and Planetary Astronomy
M - Meteorology
P - Special Projects
R - Radio Astronomy
S - Solar Physics
T - Test and Support

LIST OF PAYLOADS

4.131 UA	14.167 GI
4.208 UA	14.373 GI
4.299 UA	14.388 UA
4.311 UA	14.413 UG
4.321 UA	14.414 UG
4.322 UA	14.418 UA
4.327 NA	14.424 GI
	14.425 GI
8.52 UA	14.456 CI
8.55 UE	14.457 CI
8.56 UE	14.464 UA
8.57 UE	
8.60 CE	17.005 GT
	17.006 UE
10.277 NA	17.008 CG
10.278 NA	17.009 UG
13.005 UG	18.072 UE
13.007 GG	18.073 UE
13.011 UG	18.082 UA
13.060 GP	18.091 UE
	18.097 GI
	18.098 GI
	18.099 GI
	18.106 GA
	18.107 GA
	18.111 UE
	18.112 UE

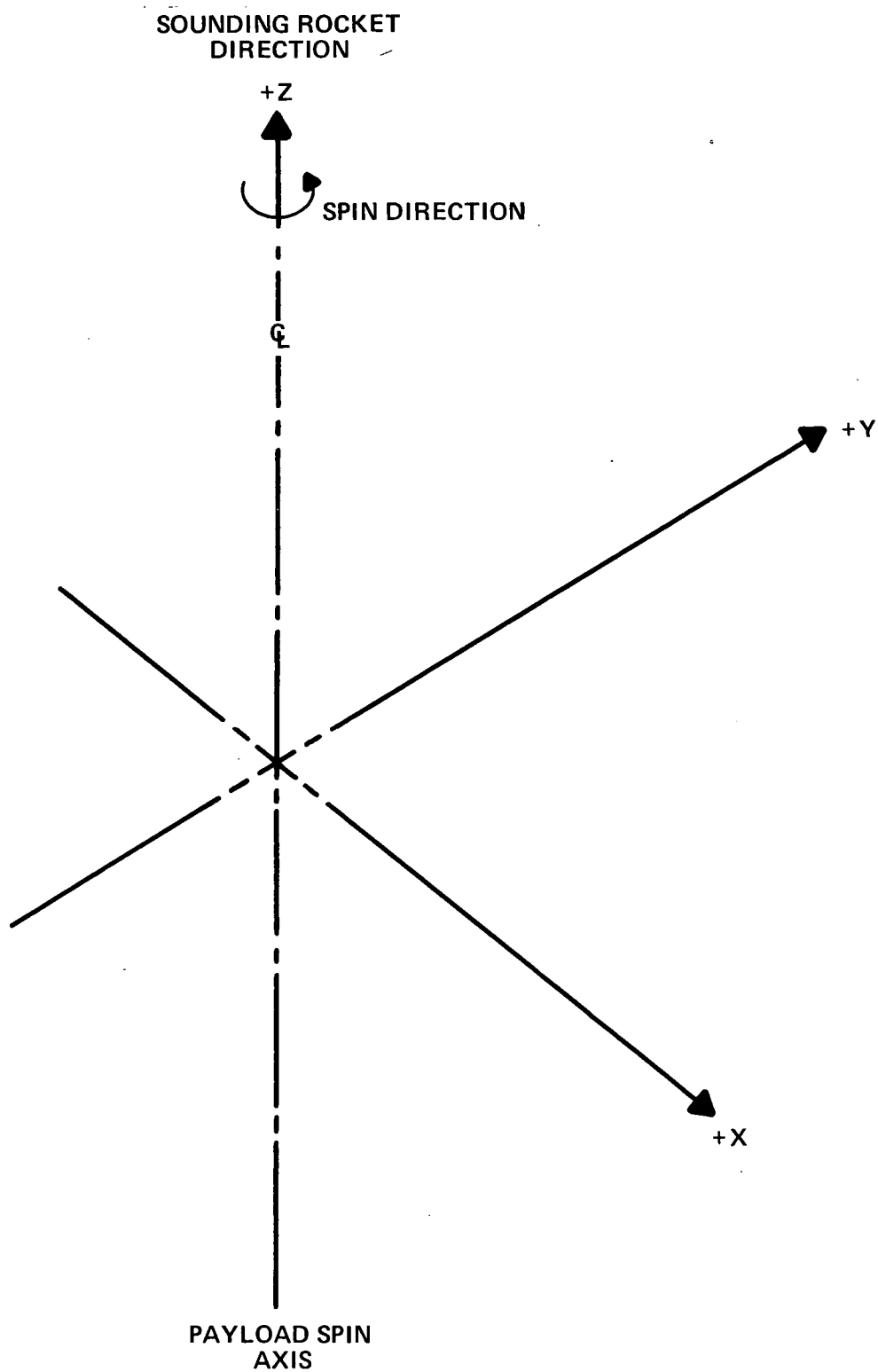


Figure 1. Sounding Rocket Coordinate System

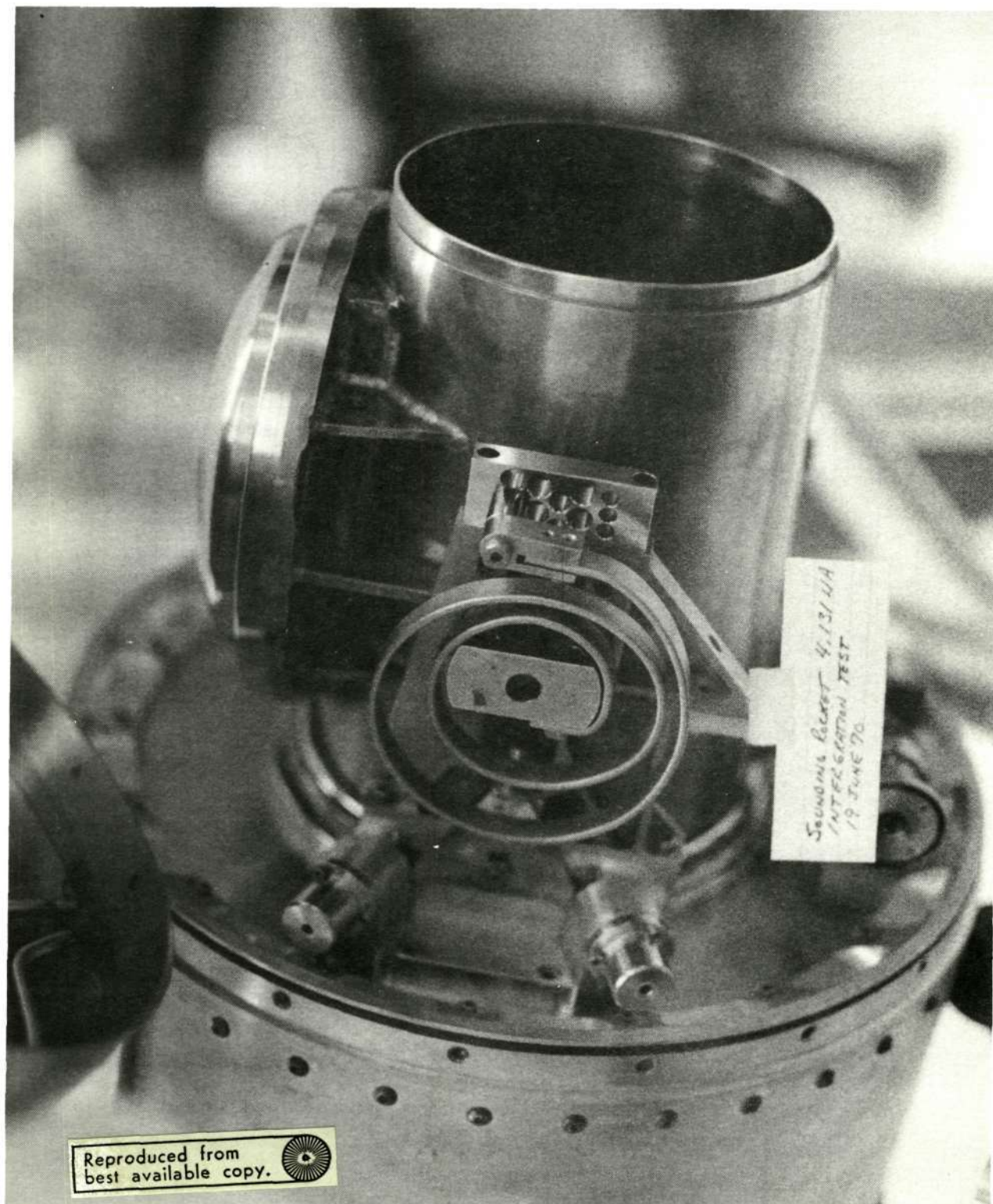
COMPILATION OF ROCKET DATA; INCLUDING WEIGHTS, BALANCE, CG, AND MOMENTS OF INERTIA.															
UPDATED AS OF : FEBRUARY 2, 1972						PREPARED BY: INTEGRATION SECTION- JOHN FITZ & JOHN J WOLFF									
DATE	PAYLOAD NUMBER	WEIGHT		BALANCE		FINAL C G INCH FROM	INITIAL UNBALANCE		RESIDUAL UNBALANCE		MOMENT OF INERTIA			BALANCE ROTATION RATE IN RPM	REMARKS
		INITIAL LBS	FINAL LBS	WGT LBS	ADDED %		STAT OZ	DYN OZ	STAT OZ	DYN OZ	ROLL IN	PITCH IN	YAW IN		
J A V E L I N															
01-08-70 01-27-70	8.55	187.6	202.6	14.27	7.0	18.64 INT FACE	N.A.	N.A.	1.0	11.0	1.49	5.37	5.40	400	
01-22-70 01-28-70	8.56	185.63	200.90	14.25	7.1	18.66 INT FCE	N.A.	N.A.	0.4	16.0	1.46	5.19	5.35	400	
01-26-70 01-29-70	8.57	114.90	147.00 122.77	06.18 01.69	1.5 1.5	17.80 INT 16.49 FCF	N.A.	N.A.	2.1	07.0	1.24	4.27	N.A.	540	WITH NOSE CONE WITHOUT NOSE CONE
07-14-70 07-14-70	8.52		112.83 089.50			15.02 AFT 11.61 FND	N.A.	N.A.	1.7	10.0	1.14 0.81	2.96 1.25	N.A.	N.A. N.A.	WITH NOSE CONE WITHOUT NOSE CONE
01-14-72	8.60	102.6	103.0 127.7	.4	17.07	MTR N.A. 18.52 INT	N.A.	N.A.	.58	3.31					
05-11-71	8.60	92.0 122.6	3.8 126.6	3.0	17.35	AFT N.A. 12.75 INT	N.A.	N.A.			.94 1.29	2.75 3.99	2.74 3.97	540 540	W/O NOSE CONE--TAR 20399 WITH NOSE CONE-M.I TOL 5% W/O NOSE CONE--TAR 19273 WITH NOSE CONE-M.I TOL 5%
N I K E T O M A H A W K															
01-27-70 01-29-70	18.97	112.60	113.20	00.60	0.5	31.5 AFT END	11.6	845	2.0	60.0	0.27	6.10	N.A.	300	WITHOUT NOSE CONE AND SEP SECT HALFCONE ANGLE=1.4 DEG
01-23-70 01-26-70	18.98	155.30 112.80	156.55 114.05	01.25	0.8 1.0	39.92 AFT 31.67 FND	107. 75.	1144 898	31.0 10.0	246.0 220.0	0.39 0.28	17.4 6.10		300	WITH NOSECON & SEP SECT W/O NOSECON & SEP SECT HALFCONE ANGLE =1.5 DEG
02-09-70	18.107	182.20	188.76	06.56	3.6	46.34 AFT	N.A.	N.A.	31.0	1584.0	0.52	39.7	N.A.	200	WITH BOOSTER HALFCONE ANGLE =1.0 DEG
02-11-70	18.106	181.50	189.00	07.50	4.0	45.78 AFT	N.A.	N.A.	13.0	774.0	0.51	40.4	N.A.	200	WITH BOOSTER. HALFCONE ANGLE =0.5 DEG
02-13-70	18.99	150.80	150.80	N.A.	N.A.	44.87 AFT	44.0	2676	N.A.	N.A.	0.68	20.5	N.A.	300	WITH BOOSTER. HALFCONE ANGLE =2.0 DEG
03-11-70	18.82	218.50	223.60	05.10	2.3	55.65 AFT	N.A.	N.A.	0.9*	189.0	0.56	45.0	N.A.	150	* WITH BOOSTER
03-27-70	18.91	183.00	183.00	NONE	N.A.	45.88 AFT	<200	<13K	N.A.	N.A.	0.44	35.3	N.A.	150	UNBALANCE ABOUT THE PAY- LOAD. BURNED OUT MOTOR CG 18 IN AFT OF PAYLOAD AFT- MOST SURFACE. HALFCONE ANGLE =7.0 DEG

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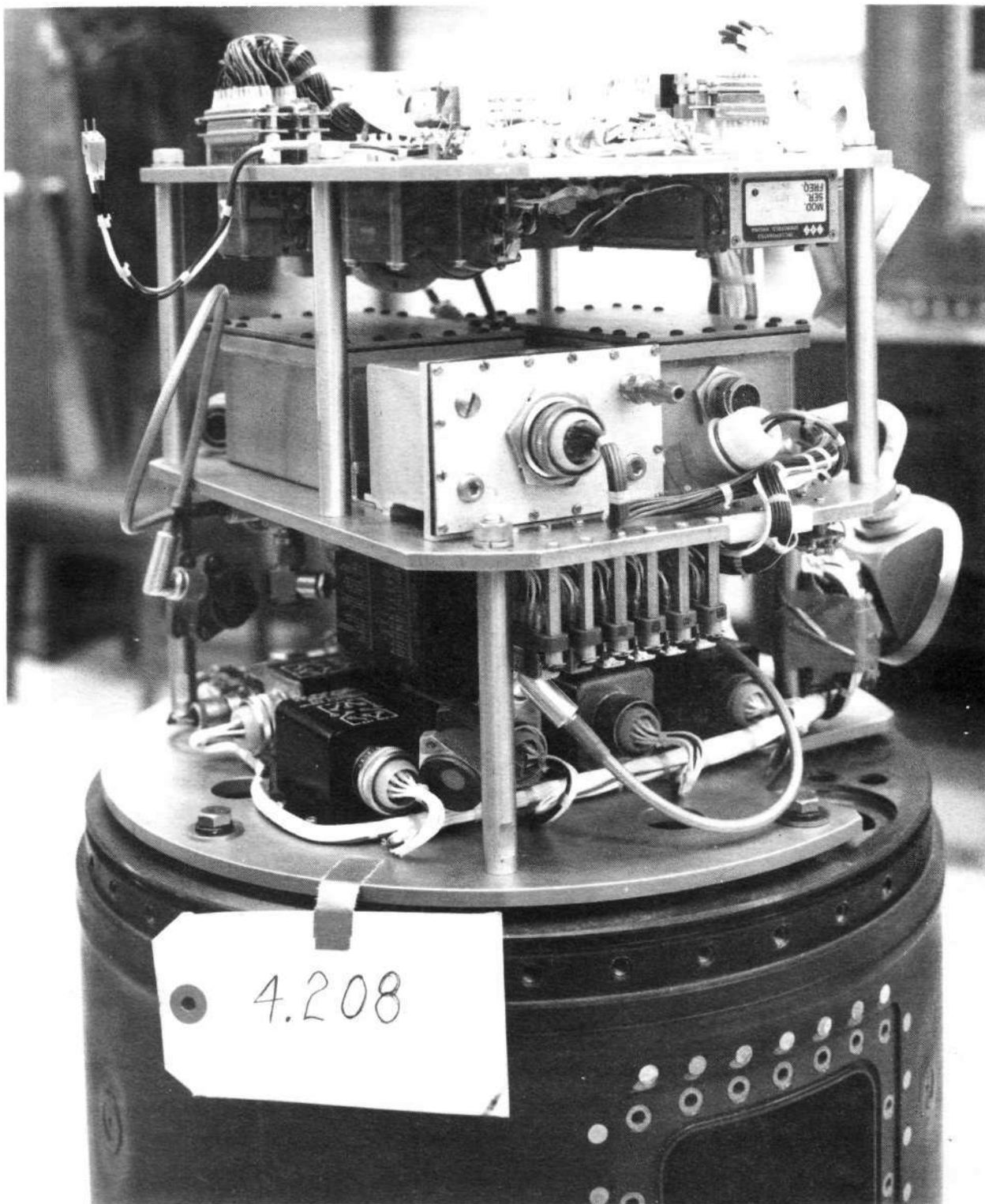
DATE	PAYLOAD NUMBER	WEIGHT		BALANCE WGT ADDED		FINAL C G INCH FROM	INITIAL UNBALANCE		RESIDUAL UNBALANCE		MOMENT OF INERTIA			BALANCE ROTATION	REMARKS
		INITIAL LBS	FINAL LBS	LBS	%		STAT OZ	DYN IN	STAT OZ	DYN IN	ROLL IN	PITCH SLUG	YAW FT		
N I K E T O M A H A W K (CONTINUED)															
06-18-70	18.72	208.80	208.80	N.A.	N.A.	52.67 AFT	N.A.	N.A.	N.A.	N.A.	0.56	54.1	N.A.	N.A.	
11-19-71	18.111	215.00	222.91	7.91	N.A.	46.49 PLD INT	396.	380.	1.4	479.0	0.56	44.4	N.A.	300	COMPLETE PAYLOAD PAYLOAD AND SUSTAINER PAYLOAD AFTER D3JR EJECT PLD AND SUS AFTR DR EJECT PAYLOAD WITH BOOSTER W/O NOSE CONE
12-16-71	18.112	207.6	209.1	1.51	0.7	45.95 AFT	N.A.	N.A.	16.4	460.0*	.532	40.2	N.A.	360	WITH NOSE CONE
11-22-71	18.73	220.0	220.0	N.A.	N.A.	54.22 AFT	75.0	3943	N.A.	N.A.	.56	50.9	N.A.	300	32 LBS BALLAST ADDED- NOSE
12-17-71	18.73	242.3	242.3	N.A.	N.A.	59.63 AFT	159.	2030	N.A.	N.A.	.617	59.8	N.A.	300	
A E R O B E E 1 7 0															
01-07-70		209.10	209.10	N.A.	N.A.	66.67 AFT	27.0	5140	N.A.	N.A.	1.02	49.6	N.A.	175	M.I. TOLERANCE =0.5%
05-27-70	13.05	018.90	019.20	00.30	1.6	06.00*EST	N.A.	N.A.	0.4	24.6	N.A.	N.A.	N.A.	400	NOSECONC ONLY *UNBAL EST. FROM 6 IN FWD OF AFT SURF OF SEP MECHANISM.
06-09-70	13.05	293.80	297.70	03.90	1.3	40.16*AFT	N.A.	N.A.	56.0	1373.0	1.95	48.2	48.3	150	*AFT END BEFORE SEP SECT.
08-17-70	13.07	292.00	292.00	N.A.	N.A.	47.51 AFT	4.40	N.A.	N.A.	N.A.	1.58	37.5	37.5	050	M.I. TOLERANCE =0.5%
11-18-70	13.11	234.10	234.10	N.A.	N.A.	50.51 INT	528*	1480	N.A.	N.A.	1.72	41.3	N.A.	150	*COMPUTED AT COMPOSITE CG OF BOOSTER & PAYLOAD = 4400 OZ IN SQ. HALFCONE ANGLE =6.5 DEG
10-14-71 THRU 11-03-71	13.61	435 * 635 * 1145 * 1731 *													CLAMP W/O SHOES CLAMP WITH SHOES DOOR NO 1 DOOR NO 2 ** WT IN GRAMS DOOR NO 3 DOOR NO 4 SHELL AND NOSE CONE NOSE CONE BASE RING
SUMMARY OF MASS PROPERTY		1734 * 76.9 19.1 13.1 13.1 13.1 13.2 52.5				16.02 AFT END 30.73 AFT END	9.0	549.			.737 .080 .099				NOTE: PETAL NO 1 PETAL NO 2 LIGHT SPOT IN PETAL NO 3 PETAL NO 2 PETAL NO 4 ALL FOUR PETALS
											.267	.265	.035		
											.491				

DATE	PAYLOAD NUMBER	WEIGHT		BALANCE		FINAL C G INCH FROM	INITIAL UNBALANCE		RESIDUAL UNBALANCE		MOMENT OF INERTIA			BALANCE ROTATION	REMARKS
		INITIAL	FINAL	WGT ADDED			STAT	DYN	STAT	DYN	ROLL	PITCH	YAW		
		LBS	LBS	LBS	%		0Z IN	0Z IN	0Z IN	0Z IN	IN	SLUG	FT	RATE IN RPM	
							IN SQ	IN SQ	IN SQ	IN SQ			SQ		
							A E R O B E E		1 5 0						
11-03-71	4.208	355.6	355.6*	N.A.	N.A.	64.00 AFT	563	12K	N.A.	N.A.	N.A.	N.A.	N.A.	150	CONFIGURATION OF PAYLOAD NOT DEFINED BY PROJECT.
03-09-70	4.321	196.60	202.10	05.50	2.8	64.53 AFT	475.	9859	133.	1179.0	0.89	42.0	N.A.	150	M.I. TOLERANCE =0.5% ALL MEASUREMENTS WITH DUMMY PARACHUTE PACK W/D CHUTE.
04-06-70	4.327	369.50	369.50	N.A.	N.A.	48.95 AFT	N.A.	N.A.	N.A.	N.A.	2.10	91.0	91.0	N.A.	M.I. TOLERANCE =0.5%
04-21-70	4.311	184.00	184.00	N.A.	N.A.	40.31 AFT	N.A.	N.A.	N.A.	N.A.	1.22	26.0	26.0	N.A.	M.I. TOLERANCE =0.5%
04-22-70	4.322	188.50	188.50	N.A.	N.A.	39.43 AFT	1713	N.A.	N.A.	N.A.					
06-08-70	4.299	190.30	190.30	N.A.	N.A.	30.57 AFT	N.A.	N.A.	N.A.	N.A.					
06-22-70	4.131	329.70	329.70	N.A.	N.A.	61.40 AFT	402.	6900	N.A.	N.A.					
							A E R O B E E		3 5 0						
04-08-70	17.06	339.00	339.00	N.A.	N.A.	37.10 AFT	N.A.	N.A.	N.A.	N.A.	3.11	48.1	49.1	N.A.	M.I. WITH 2 COMPONENTS ADDED AFTER MASS MEASUREMENT.
11-06-70	17.08	754.78	767.50	32.70	3.0	55.75 AFT	4.58	8.80	136.	6175.0	11.8	N.A.	278.	100	W/D NOSECONE.
11-13-70	17.08	810.00	842.70			63.51 AFT					13.0	N.A.	395.	100	WITH NOSECONE.
12-14-70	17.09	864.20	898.30	17.80	2.1	69.62 AFT	N.A.	N.A.	58.0	1373.0	13.5	N.A.	436.	N.A.	WITH NOSECONE.
12-18-70	17.09						N.A.	N.A.			12.6	N.A.	325.	N.A.	W/D NOSECONE.
01-07-71	17.09										20.6	N.A.	325.	N.A.	W/D NOSECONE & DOORS DEPL.
01-15-70	17.05	044.00	044.00	N.A.	N.A.	13.24 AFT	N.A.	N.A.	N.A.	N.A.	0.69	03.9	03.9	N.A.	NOSECONE ONLY.
		430.70	430.70	N.A.	N.A.	29.40 AFT	N.A.	N.A.	N.A.	N.A.	6.14	40.1	40.2	N.A.	LOWER SECTION ONLY.
		274.90	274.90	N.A.	N.A.	37.09 AFT	N.A.	N.A.	N.A.	N.A.	4.56	26.3	26.3	N.A.	UPPER SECTION ONLY.
		705.60	705.60	N.A.	N.A.	59.82 AFT	N.A.	N.A.	N.A.	N.A.	11.4	287.	287.	N.A.	UPPER & LOWER COMPOSITE.
		661.60	661.60	N.A.	N.A.	54.71 AFT	N.A.	N.A.	N.A.	N.A.	10.4	224.	224.	N.A.	COMPOSITE LESS NOSECONE.
							N I K E		C A J U N						
10-21-70	10.278	087.00	087.00	N.A.	N.A.	39.23 AFT	N.A.	N.A.	N.A.	N.A.	0.11	09.3	N.A.	N.A.	NONE
01-19-70	10.277	080.60	080.60	N.A.	N.A.	32.85 AFT	8.0	651.	N.A.	N.A.	0.18	06.3	N.A.	N.A.	WITH NOSECONE & DOORS.
		067.60	067.60	N.A.	N.A.	28.27 AFT					0.11	03.9	N.A.	N.A.	W/D NOSECONE & DOORS.
06-03-70		063.95	063.95	N.A.	N.A.	27.86 AFT	N.A.	N.A.	N.A.	N.A.	0.09	03.9	N.A.	N.A.	

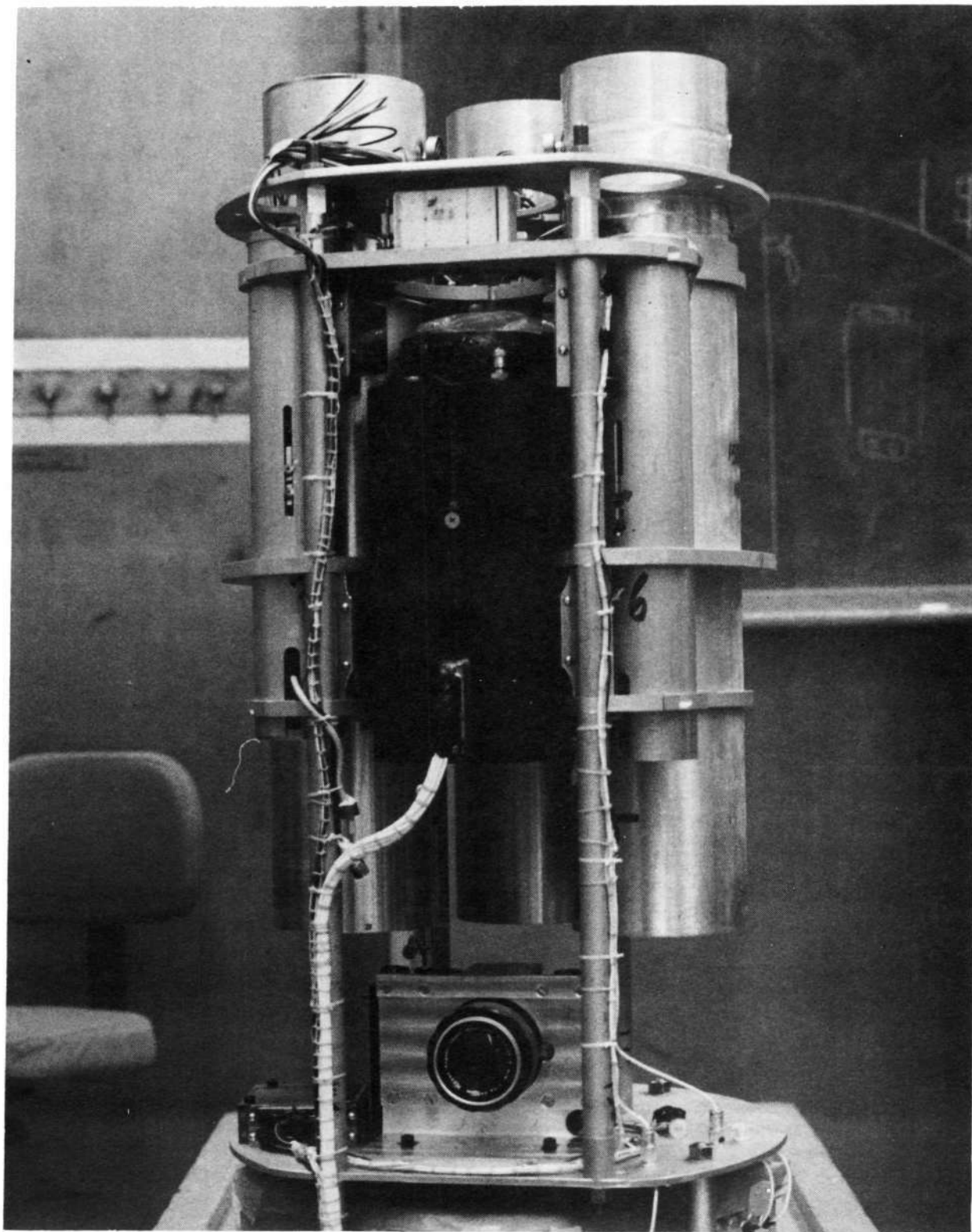
DATE	PAYLOAD NUMBER	WEIGHT		BALANCE		FINAL C G INCH FROM	INITIAL UNBALANCE		RESIDUAL UNBALANCE		MOMENT OF INERTIA			BALANCE ROTATION RATE IN RPM	REMARKS
		INITIAL LBS	FINAL LBS	WGT ADDED LBS	%		STAT OZ IN	DYN OZ IN SQ	STAT OZ IN	DYN OZ IN SQ	ROLL IN	PITCH SLUG FT	YAW SQD		
N I K E A P A C H E															
01-28-70	14.425	104.95	106.30	01.35	1.2	21.92 AFT	N.A.	793.	0.16	188.0	0.25	04.1	N.A.	300	M.I. TOLERANCE =0.5% HALFCONE ANGLE =1.3 DEG
01-29-70	14.424	096.80	098.05	01.25	1.0	19.60 AFT	N.A.	845.	11.0	95.0	0.23	03.0	N.A.	300	M.I. TOLERANCE =0.5% HALFCONE ANGLE =0.4 DEG
02-12-70	14.456	058.20	N.A.	N.A.	N.A.	27.07 AFT	46.0	387.	N.A.	N.A.	0.08	03.9	N.A.	300	M.I. TOLERANCE =0.5% ALL MEASUREMENTS W/O ANT PKG.
02-12-70	14.457	058.20	N.A.	N.A.	N.A.	26.99 AFT	33.0	721.	N.A.	N.A.	0.08	03.9	N.A.	300	M.I. TOLERANCE =0.5% ALL MEASUREMENTS W/O ANT PKG.
04-30-70	14.413	081.60	081.60	NONE	N.A.	35.39 AFT	35.9	980.	N.A.	N.A.	0.10	7.98	N.A.	300	WITH NOSECONE.
05-01-70			062.60				21.3	620.			0.08	3.95	N.A.	300	W/O NOSECONE. HALFCONE ANGLE ON RKT MOTOR =>16DEG W/O NOSE ON RKT MTR =>50DEG
07-14-70	14.388	154.60	157.70	03.10	2.0	51.91 AFT	N.A.	N.A.	22.1	826.0	0.34	25.6	N.A.	250	WITH NOSECONE.
07-17-70									28.0	2030.0					W/O NOSECONE. CG W/O CLAM- SHELL = 46.54 IN FROM AFT.
05-05-70	14.418	035.40 057.00	N.A. N.A.	N.A.	N.A.	NOT MEAS.	N.A.	N.A.	N.A.	N.A.	0.18	N.A.	N.A.	N.A.	W/O ADAPTER- SKIN ONLY. WITH ADAPTER- ROLL M.I. MEAS FOR DESPIN WGT DETERM
08-04-70	14.414	109.00	110.20	01.20	1.1	35.52 AFT	N.A.	N.A.	38.0	598.0	0.12	09.4	N.A.	300	W/O NOSECONE.
08-07-70						43.34 AFT			51.0	1092.0	0.15	16.6	N.A.	300	WITH NOSECONE9
08-28-70	14.464	143.20	145.00	01.84	1.3	45.09 AFT	N.A.	N.A.	6.6	415.0	0.30	19.7	N.A.	300	ALL MASS MEAS W CHUTE PACK
12-02-70	14.418	155.00	159.20	04.18	2.7	51.79 AFT	N.A.	N.A.	24.6	588.0	0.32	24.3	N.A.	300	RETEST ON TAR 18092. ALL M.P. WITH NOSECONE.
10-12-70	14.167	128.00	129.60	01.90	1.5	34.47 AFT	82.0	669.	0.9	217.0	0.31	08.6	N.A.	300	WITH SEP SECT & NOSECONE. HALFCONE ANGLE =1.2 DEG
12-29-70	14.373	064.00	064.00	N.A.	N.A.	28.55 AFT	N.A.	N.A.	N.A.	N.A.	0.09	04.1	N.A.	N.A.	M.I. TOLERANCE =0.5%



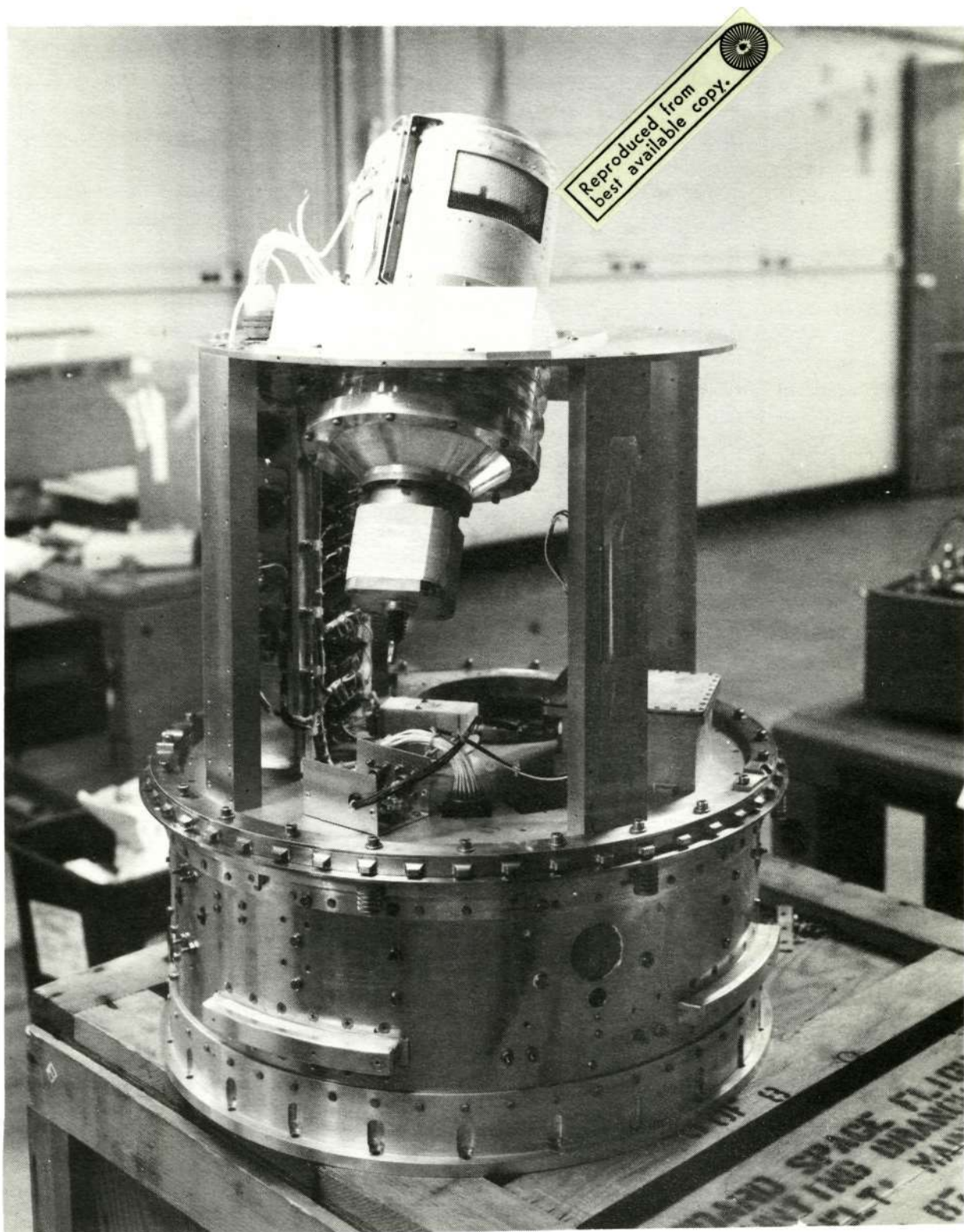
4.131 UA



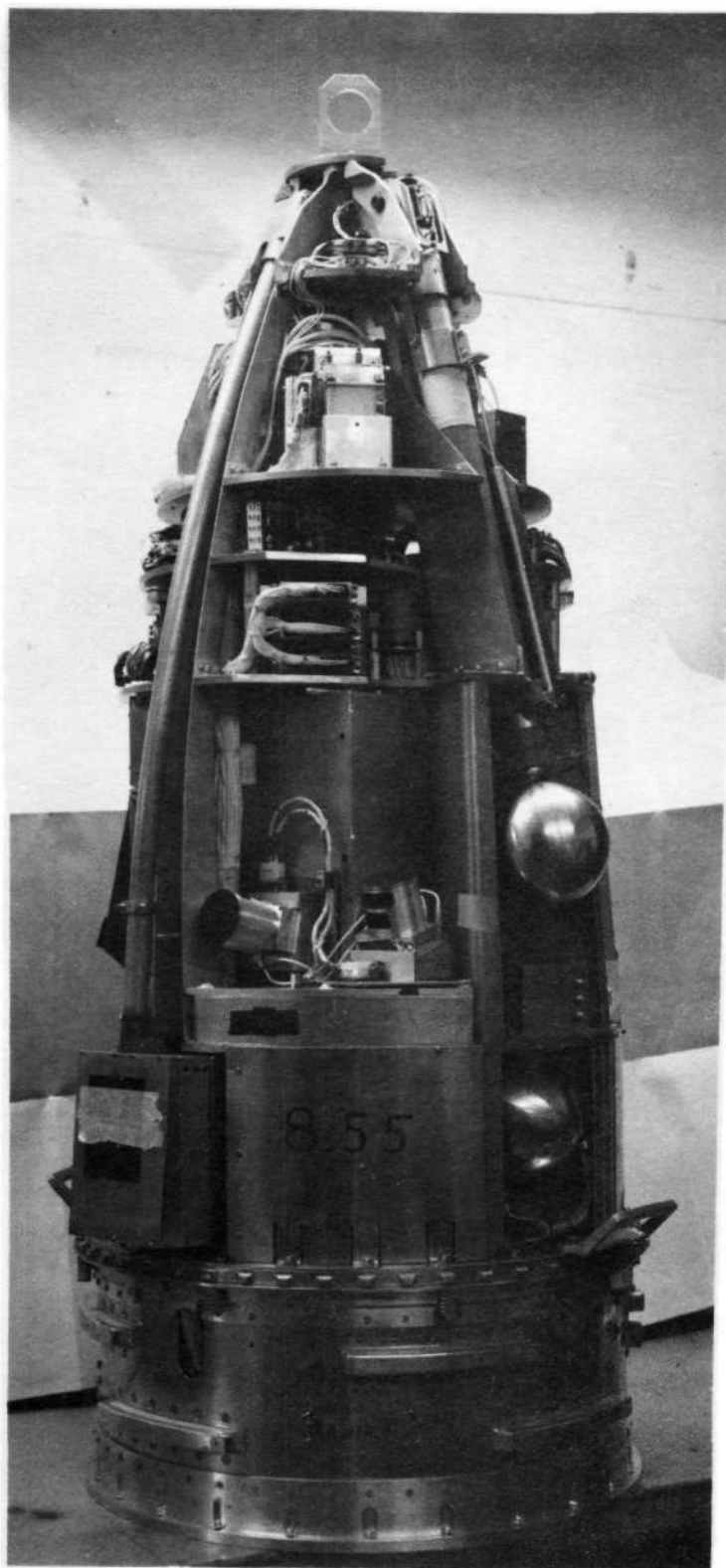
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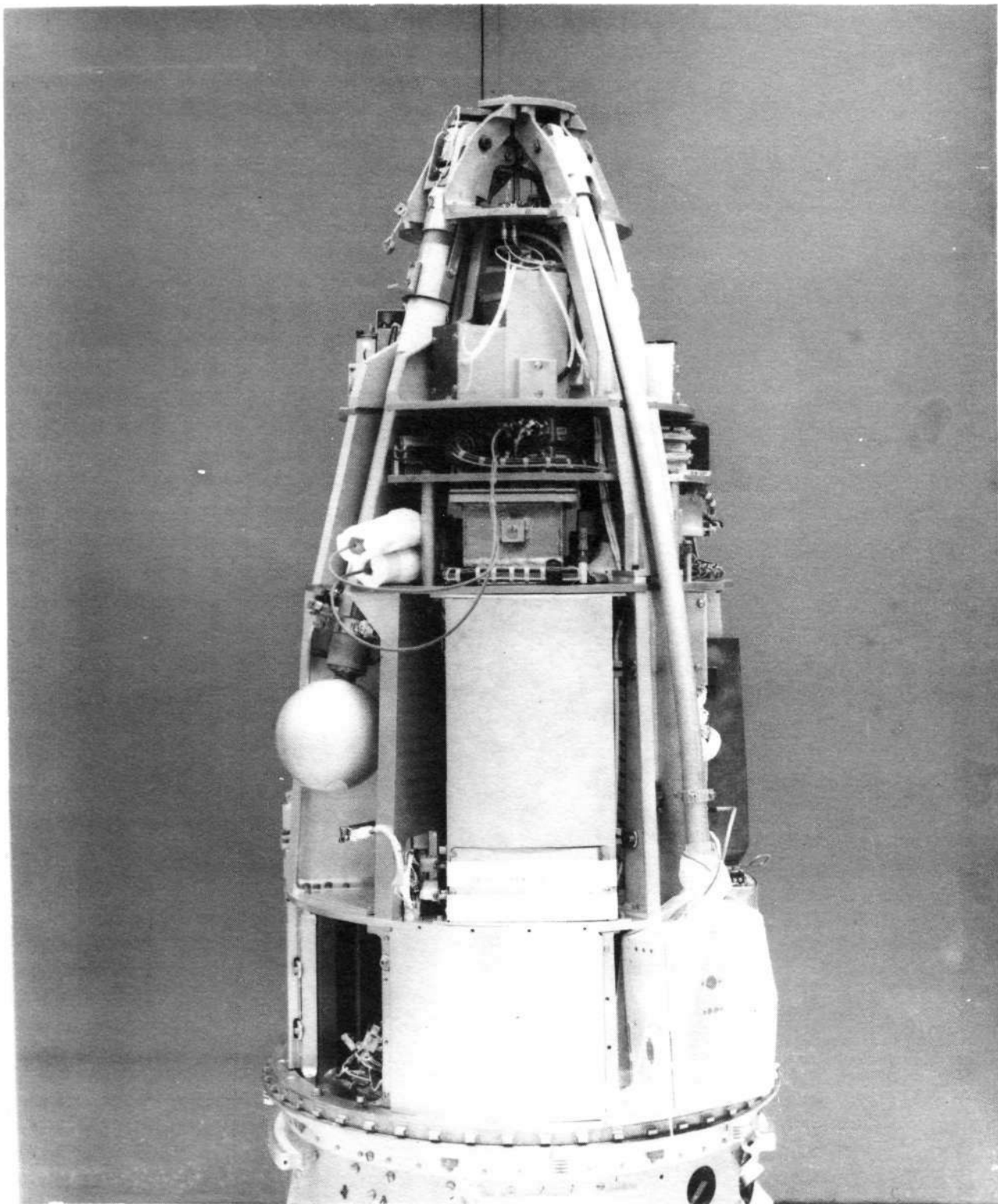
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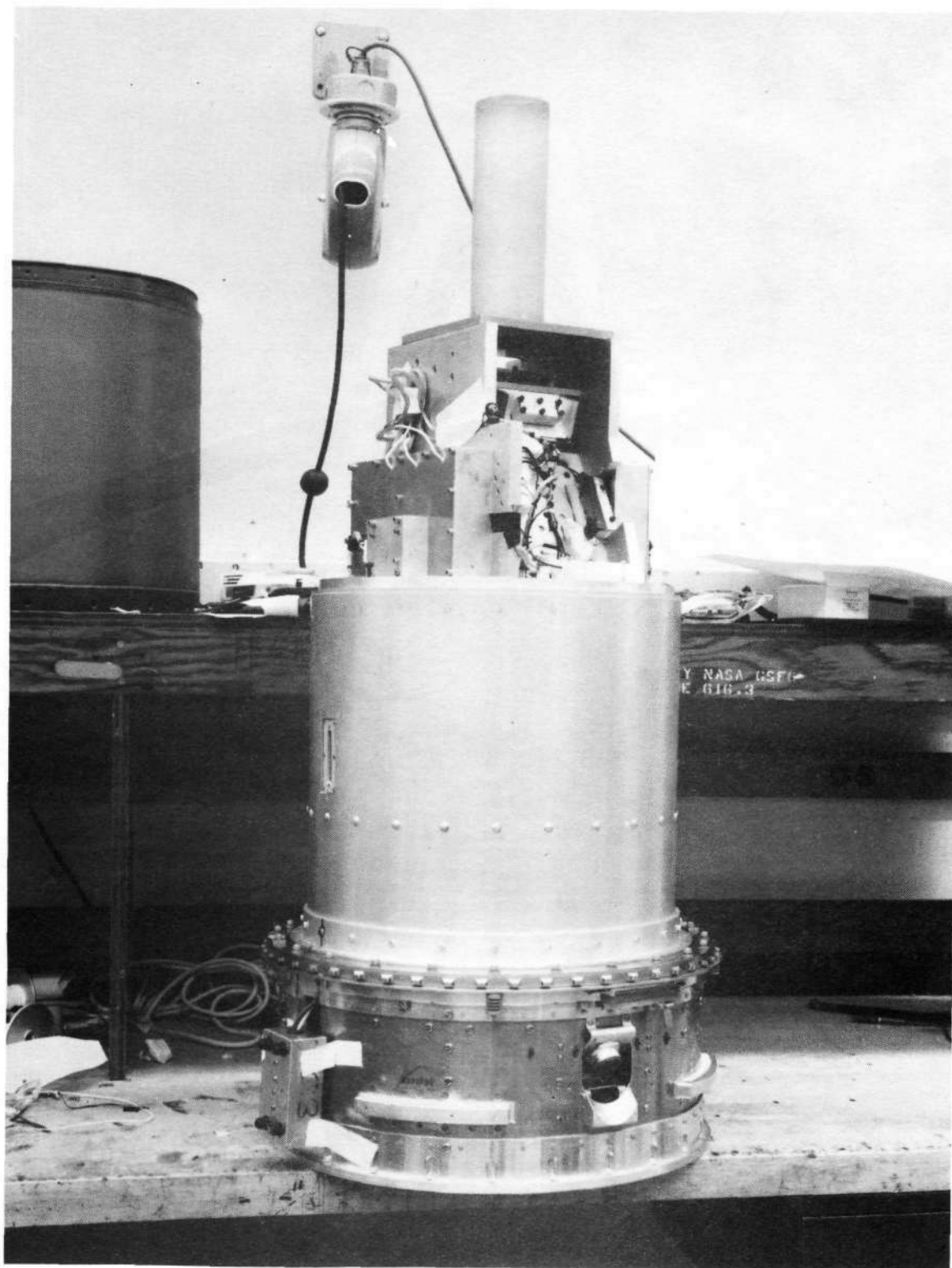
8.052 UA



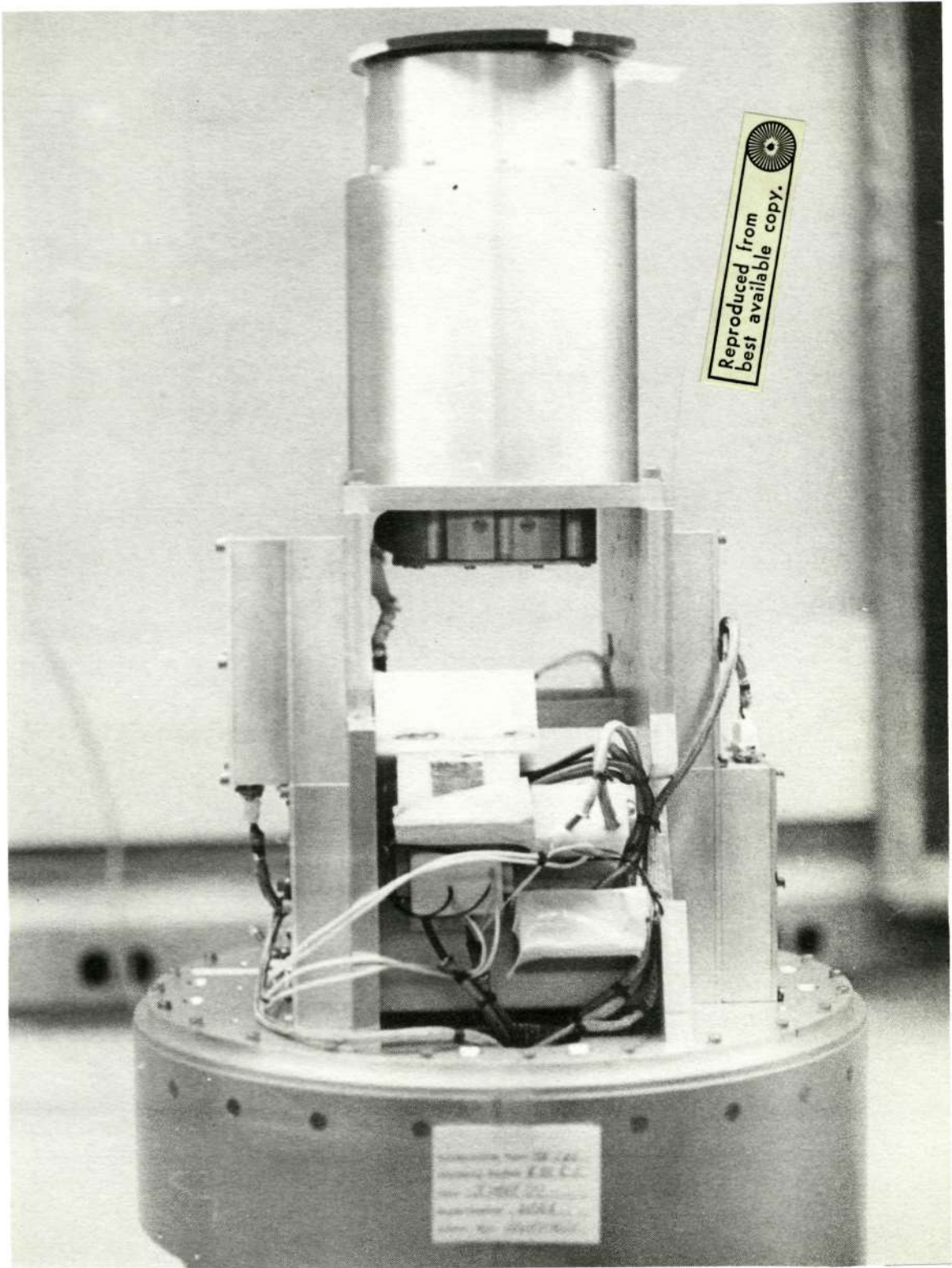
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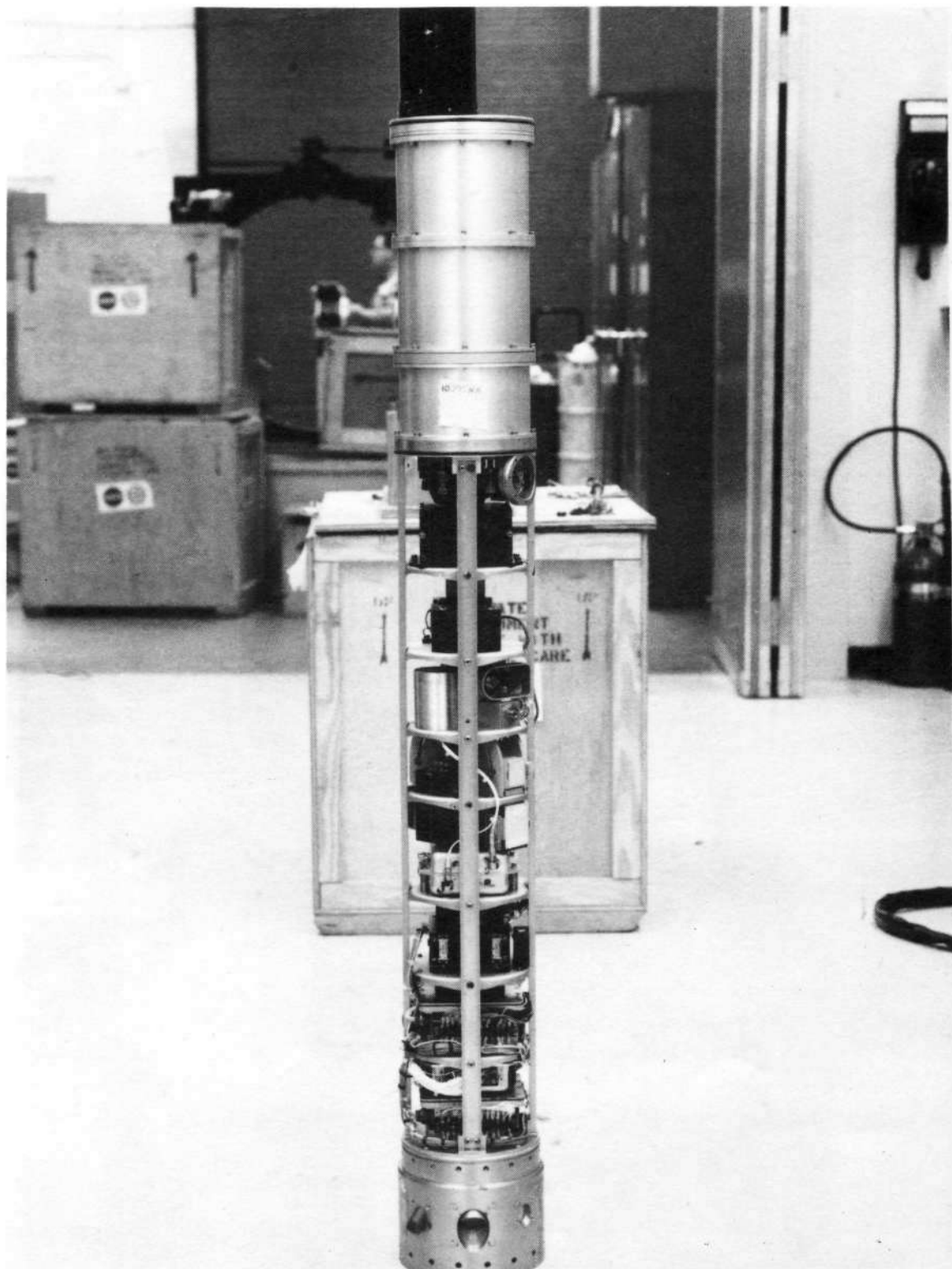
8.056 UE



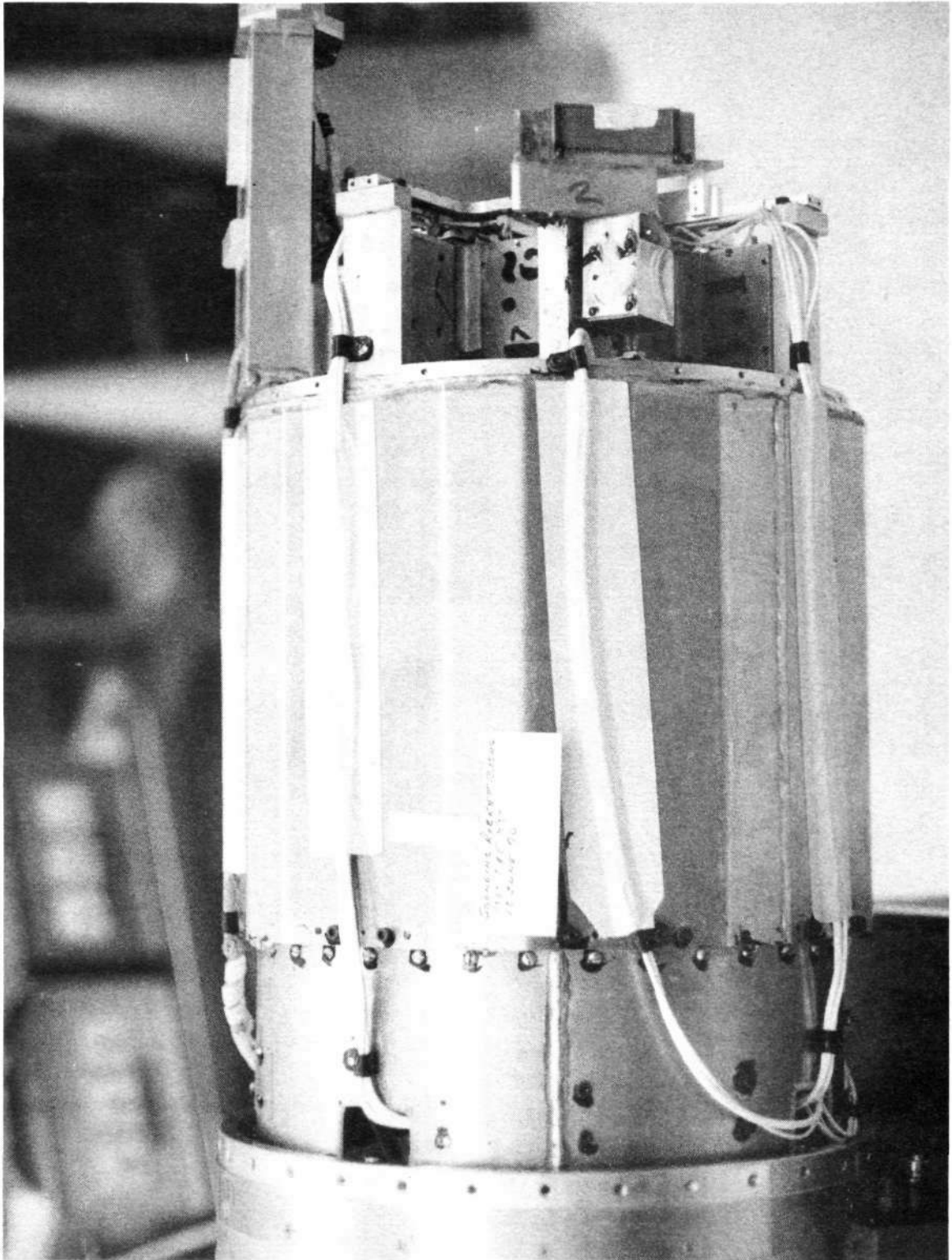
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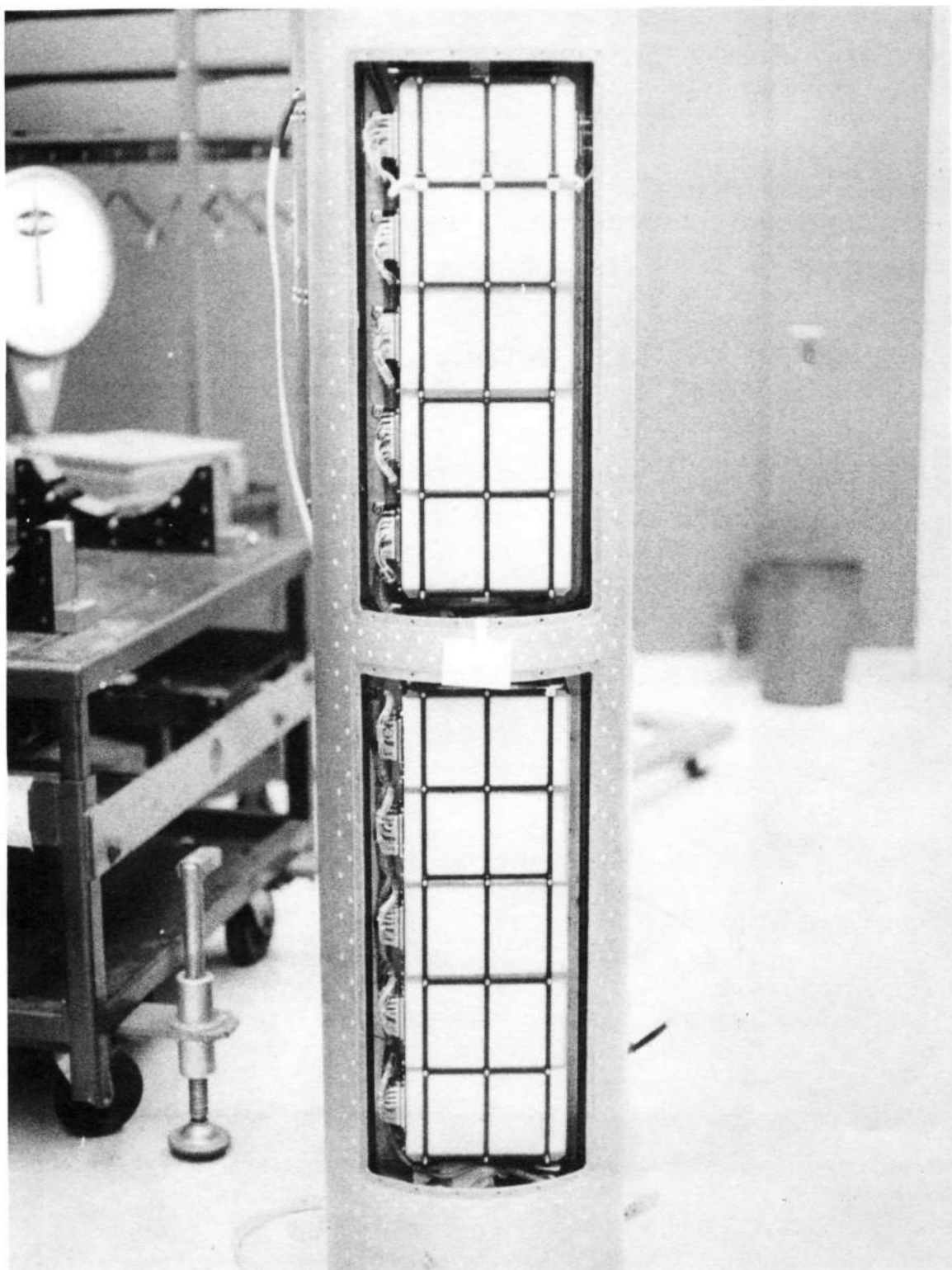
8.060 CE



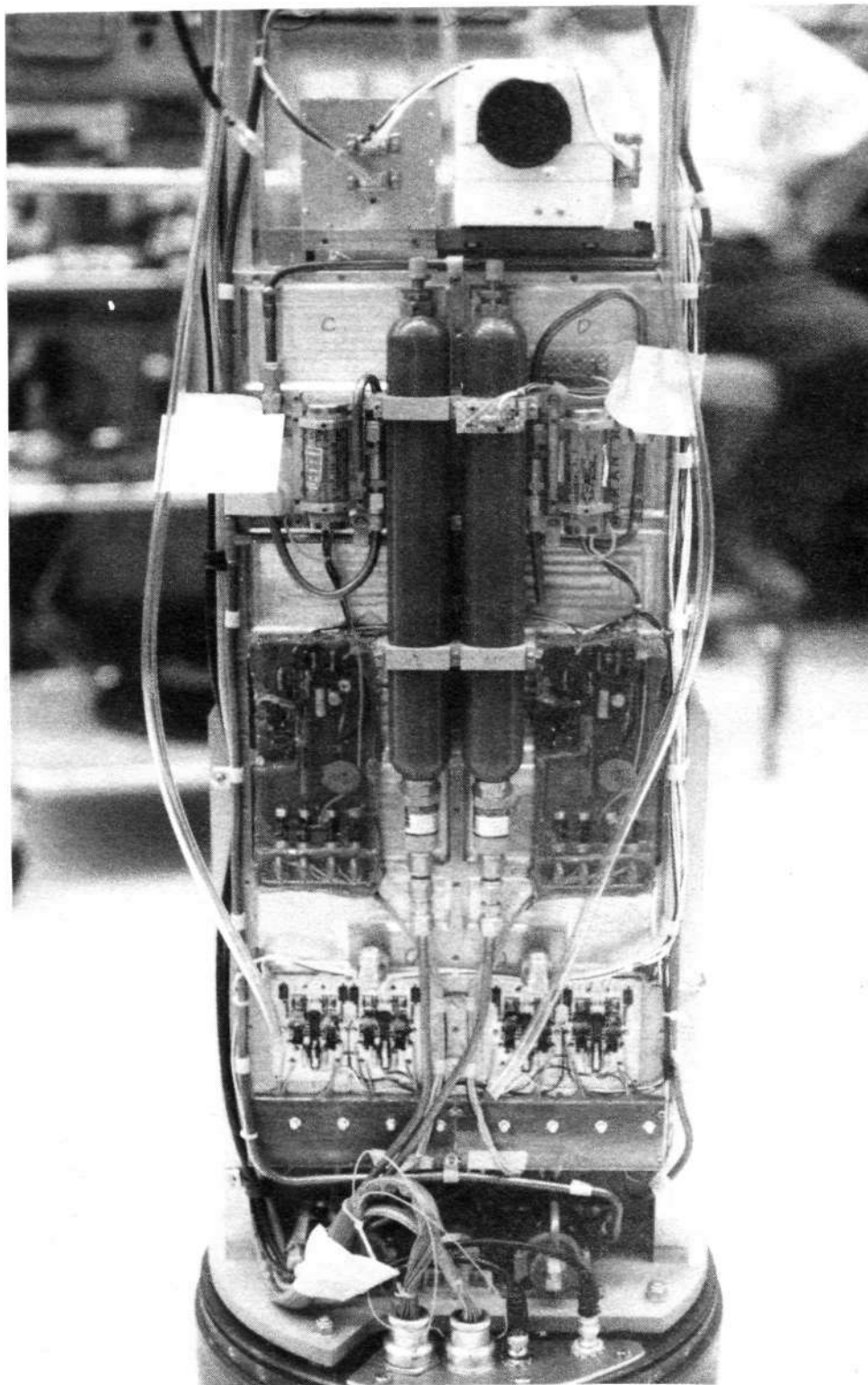
10.279 NA



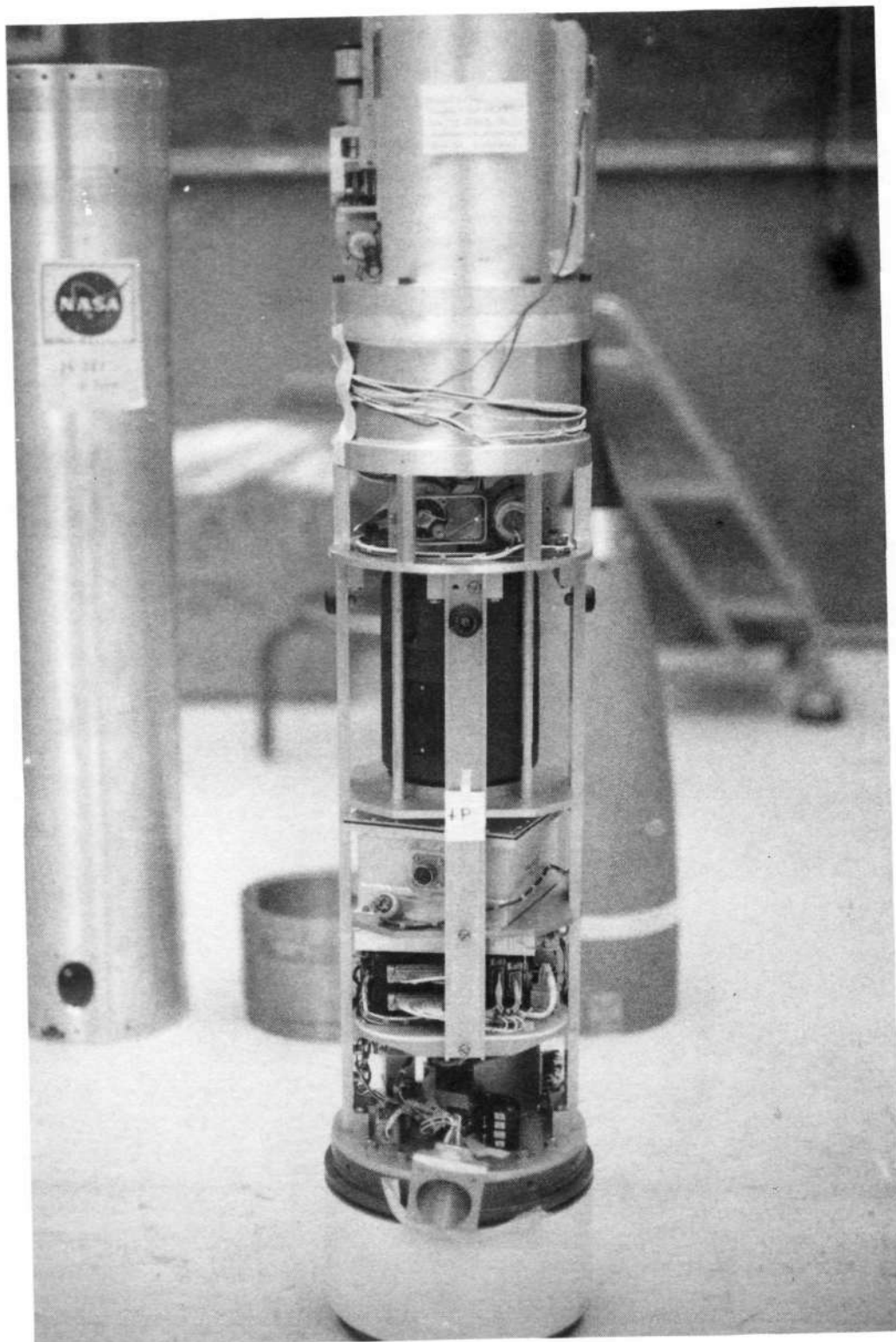
13.005 UG



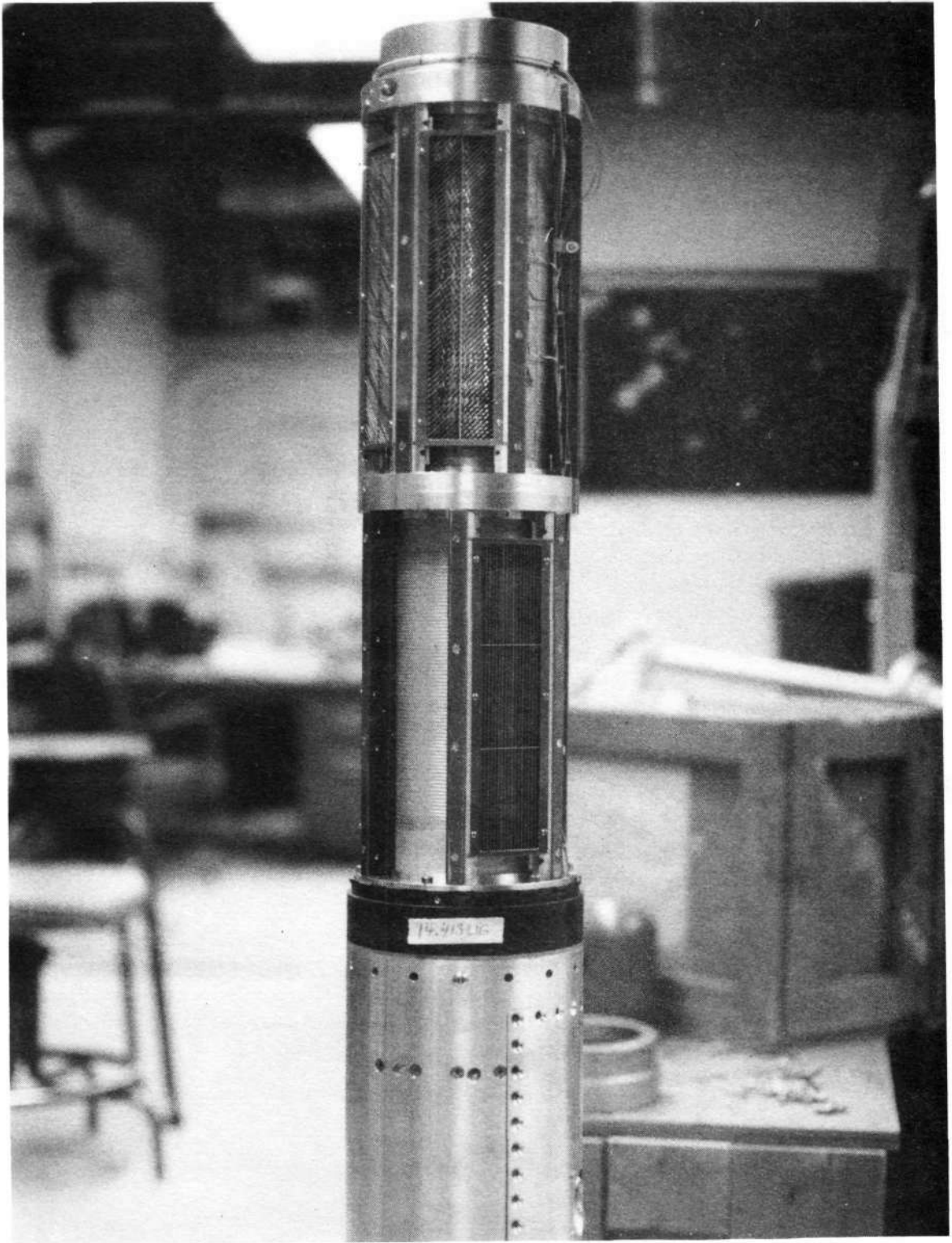
13.007 GG



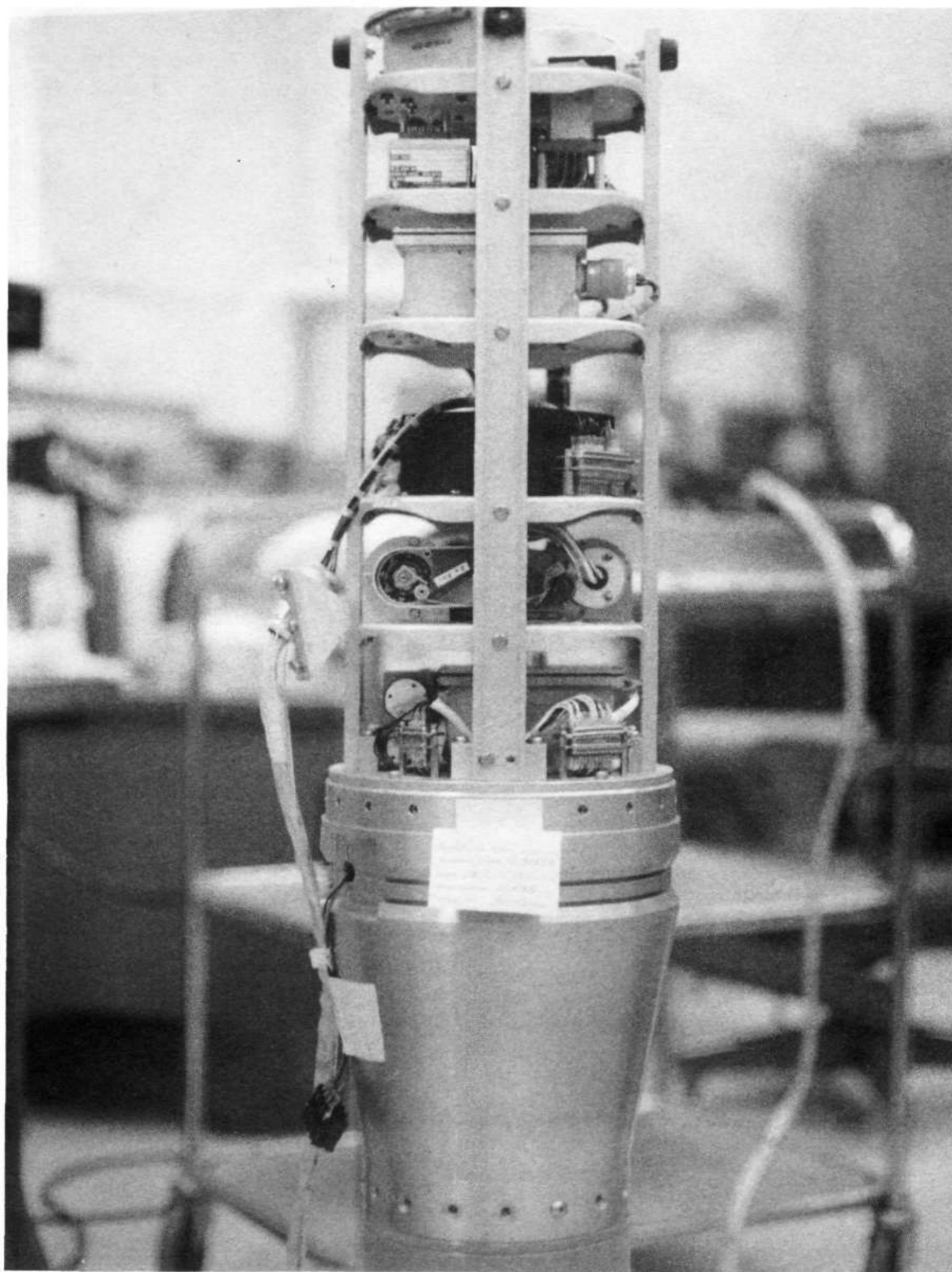
13.011 UG



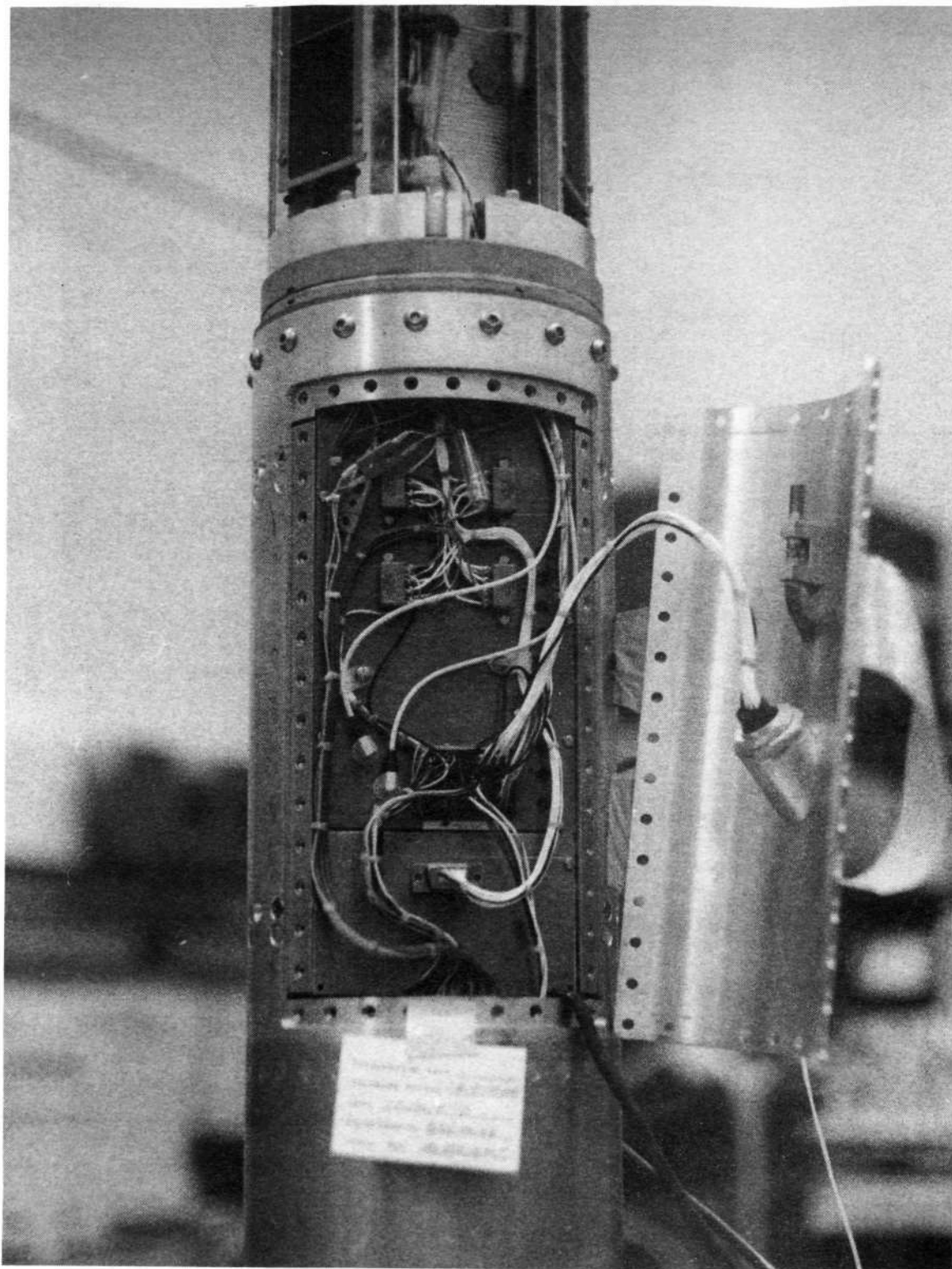
14.388 UA



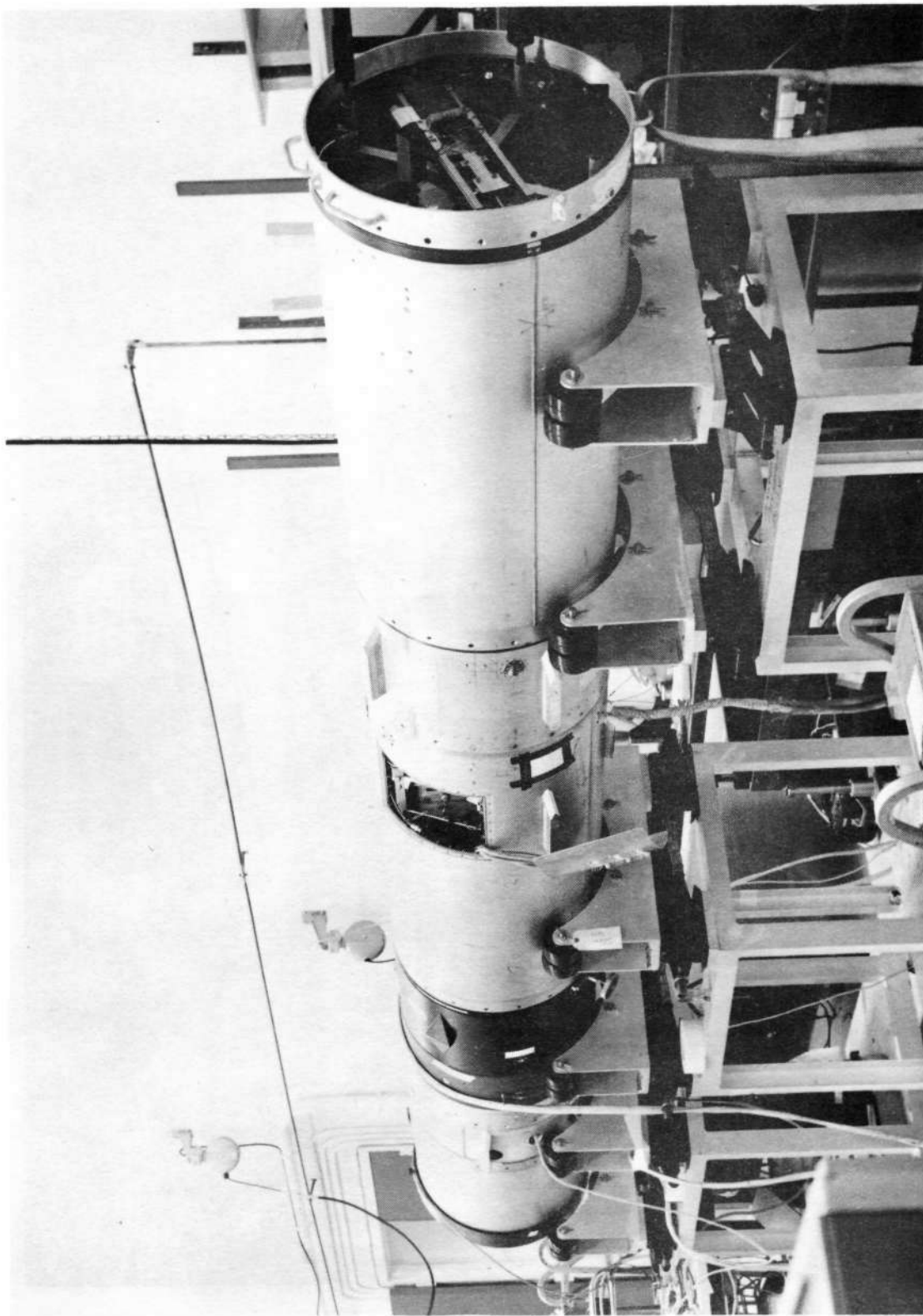
14.413 UG



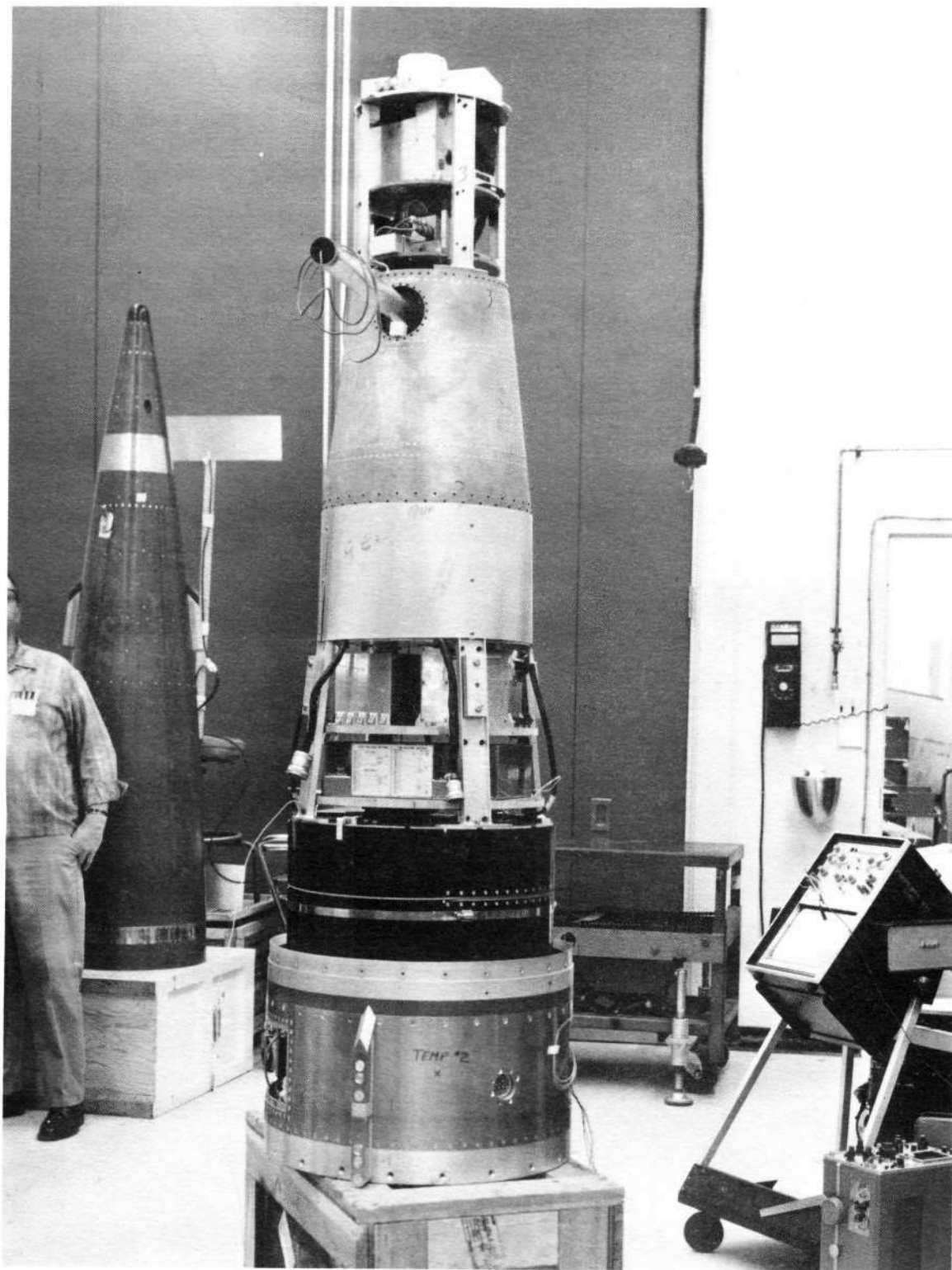
14.418 UA



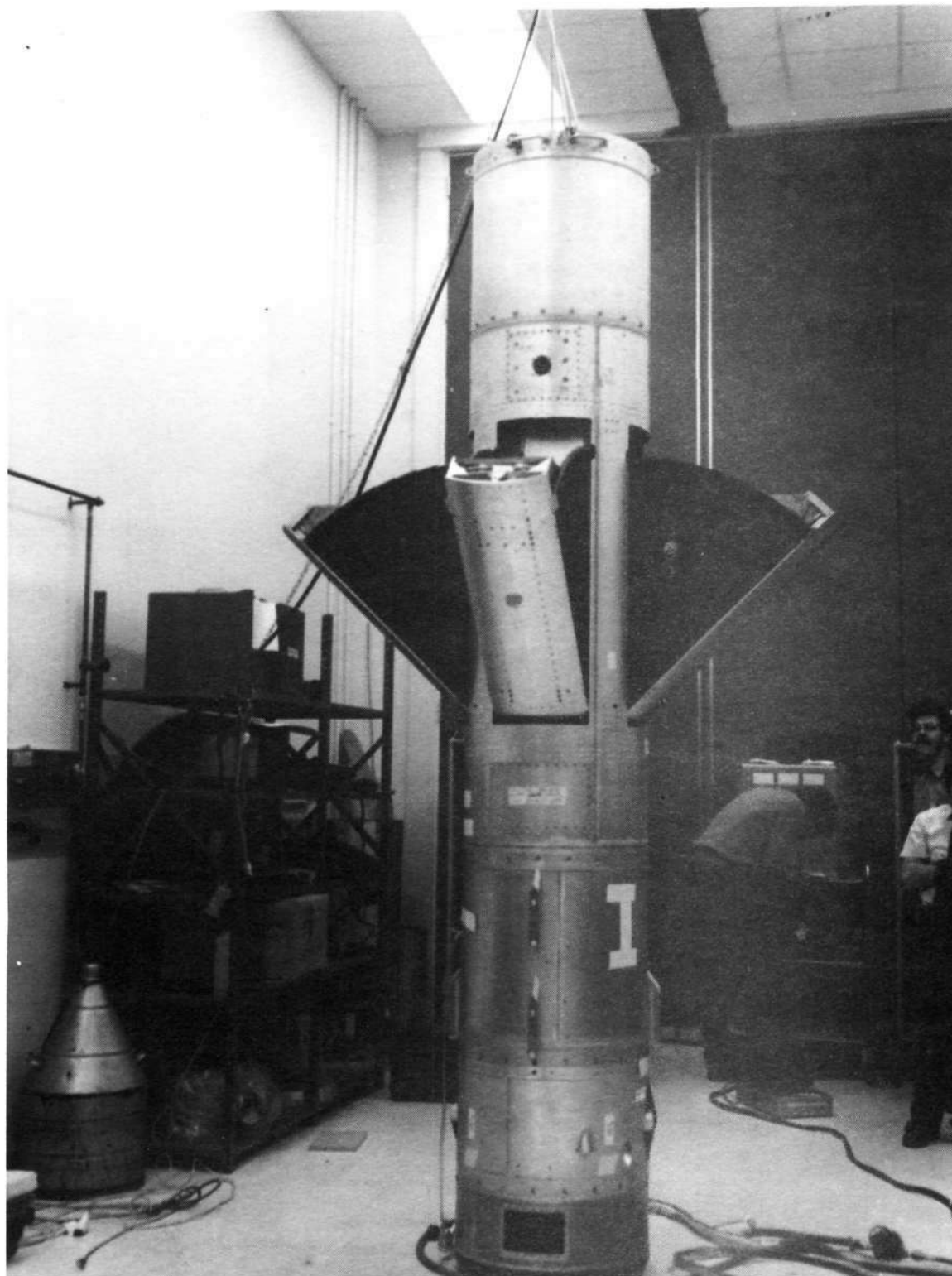
14.419 UA



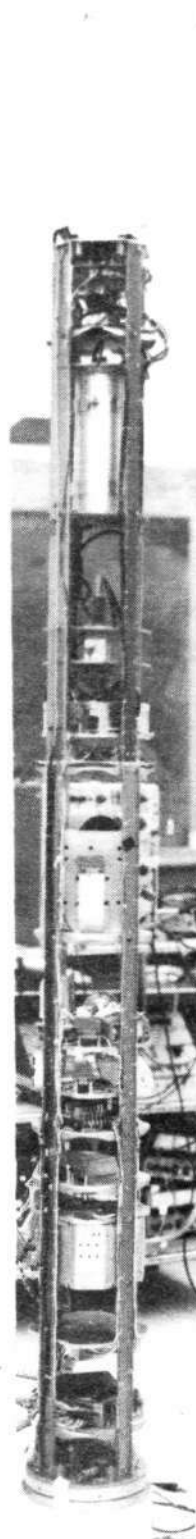
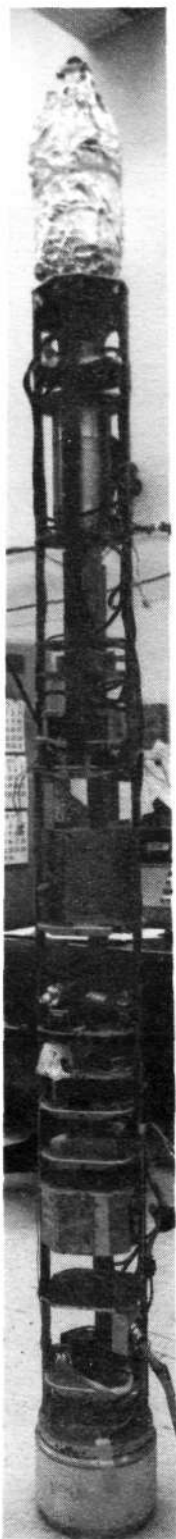
17.005 GT



17.006 UE



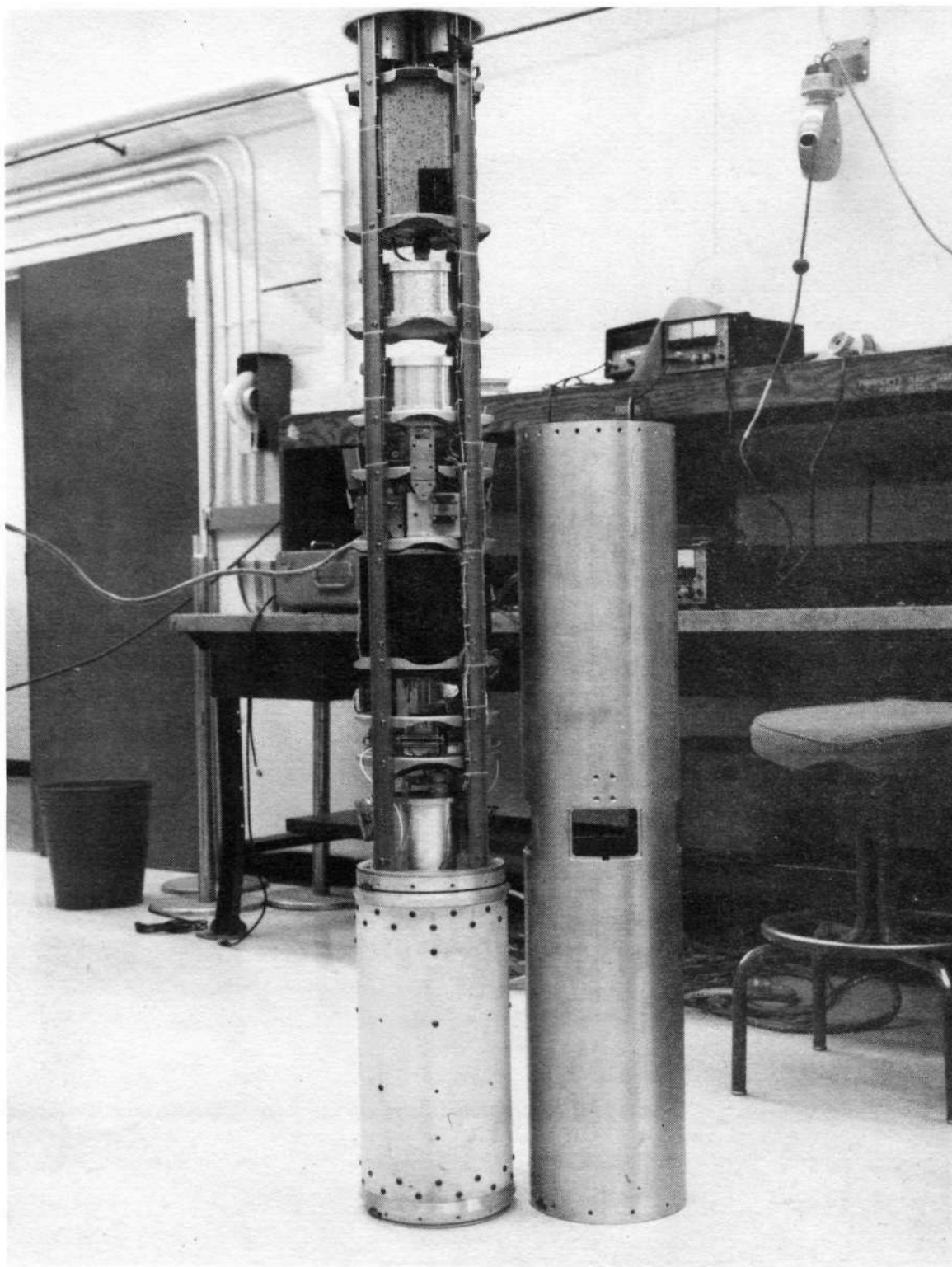
17.009 UG



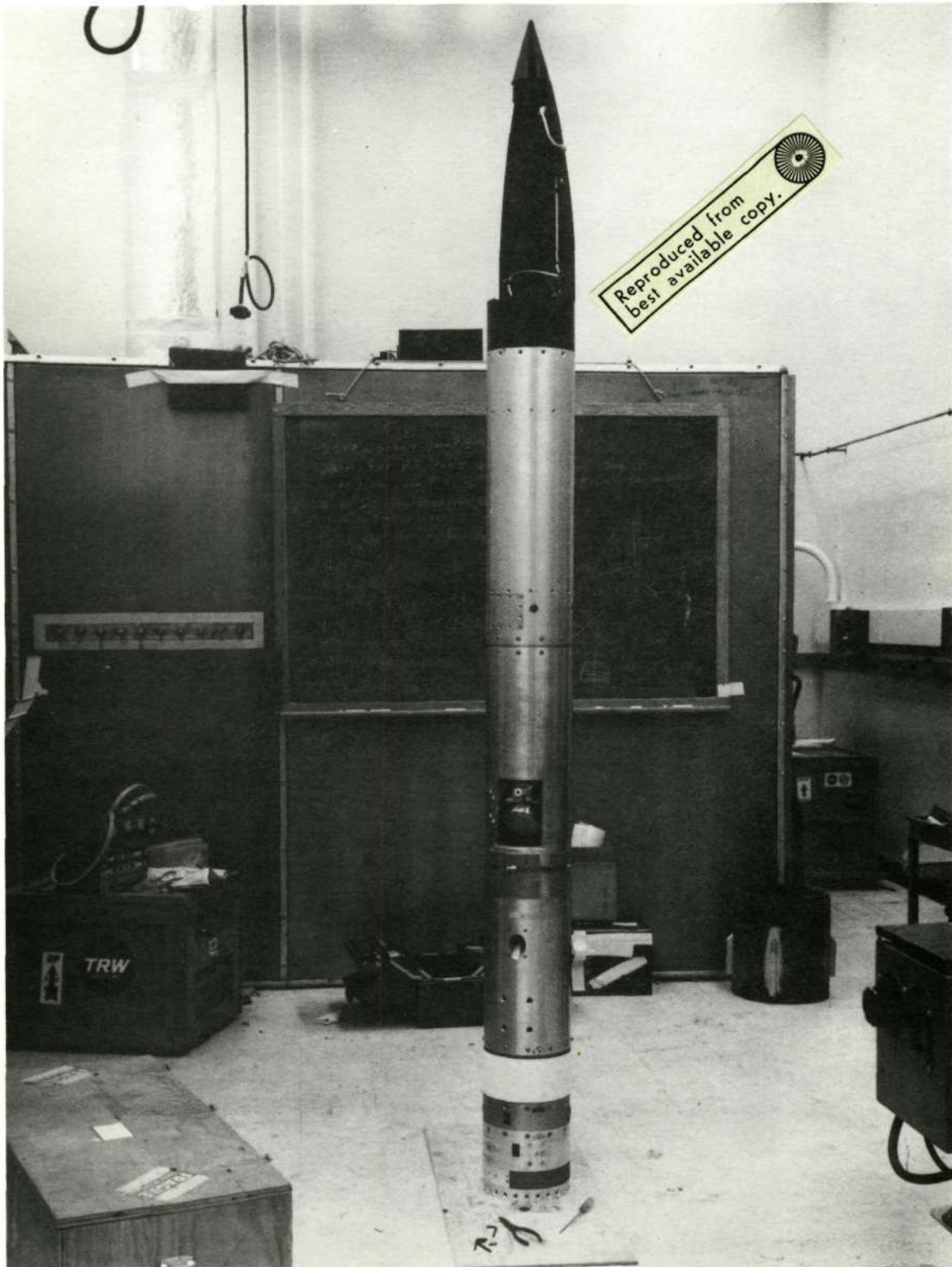
18.073 UE



18.082 UA



18.099 GI



18.106 GA & 18.107 GA